

IMPROVED PLANTER BRACKET ASSEMBLY FOR SUPPORTING APPURTENANCES IN SUBSTANTIAL ALIGNMENT WITH THE SEED TUBE

BACKGROUND OF THE INVENTION

In recent years, farmers have begun to recognize and appreciate the importance of
5 ensuring accurate and consistent spacing of seeds in the furrow to improve crop yields. To ensure more accurate in-furrow seed placement, farmers have begun attaching various types of tools or appurtenances, such as seed deflectors and seed firmers, to the seed tube of the planter to minimize in-furrow seed bounce or roll.

Examples of various types of seed deflectors adapted to be mounted directly to
10 the seed tube are disclosed in U.S. Patent Nos. 2,533,474 issued to Hyland; 5,092,255 issued to Long et al.; and 6,283,050 issued to Schaffert. Examples of various types of seed firmers adapted to be secured directly to the seed tube are disclosed in U.S. Patent Nos. 5,425,318 and 5,673,638 issued to Eugene G. Keeton, commercial embodiments of which, known as the Keeton™ seed firmers, are manufactured and distributed by
15 Precision Planting, Inc., 23207 Townline Road, Tremont, Illinois 61568. The specifications and drawings of each of the above-identified patents are incorporated herein in their entirety by reference and such seed deflectors and seed firmers are collectively referred to hereinafter as "resilient tools."

Attaching resilient tools directly to the seed tube, is often time consuming and
20 difficult due to the confined space. Furthermore, attaching resilient tools directly to the seed tube can place undue stress on the seed tube if the resilient tool makes soil contact during planting operations. Resilient tools, such as the Keeton™ firmer, for example are particularly designed to contact the bottom of the bottom of the seed furrow to embed the seed into the soil as the firmer passes over the seed. While embedding the seed into the
25 soil ensures more seed-to-soil contact resulting in more consistent and uniform seed germination, if the resilient tool is attached directly to the seed tube, the necessary force exerted by the resilient tool required to embed the seeds often places undue stress on the seed tube.

To avoid stress on the seed tube during planting operations when using a resilient
30 tool, such as the Keeton™ seed firmer, for example, Precision Planting, Inc., developed

two different styles of bracket assemblies as shown in FIGs. 2 and 3 for attaching the resilient tool operably to the planter frame as opposed to the seed tube. The two different styles were designed to accommodate the different planter styles and configurations. For example, the bracket assembly style shown in FIG. 2, is adapted for use with all John Deere planters and Kinze planters prior to the 3000 series and is designed to attach to the transverse shaft of the furrow opening discs and to the seed tube guard. The bracket assembly of FIG. 3, is particularly adapted for use on all Kinze planters and John Deere 7000 series planters and is designed to mount to the row unit frame rearwardly of, but in substantial alignment with, the seed tube. Thus, both bracket assemblies of FIGs. 2 and 3 firmly support the resilient tool in substantial alignment with the seed tube operably from the planter frame such that no stress is exerted on the seed tube by the resilient tool during planting operations.

Furthermore, as shown in FIGs. 2 and 3, in response to increase farmer demand resulting from the advent of new liquid fertilizers developed for application directly into the seed furrow, Precision Planting, Inc. adapted the bracket assemblies to support liquid conduits for in-furrow liquid application. However, as shown in FIGs. 2 and 3, the present bracket assemblies cause sharp bends in the liquid applicator tubes. It has been found that sharp bends in the applicator tubes may cause restriction in the flow of the liquid fertilizers, and, over time, the liquid fertilizers can congeal at these sharp bends, further restricting the flow through the liquid applicator tubes.

Furthermore, at least with respect to the bracket assembly of FIG. 2, it has been found that the mounting ears that attach the bracket assembly to the axle of the furrow opening discs, which are made of thermoplastic material, may eventually wear, break or tear after extended periods of use, requiring replacement of the bracket assembly.

Accordingly, there is a need for an improved bracket assembly that overcomes the problems and disadvantages of existing bracket assemblies, but which is relatively inexpensive to manufacture and which offers the ability to support a variety of in-furrow appurtenances.

SUMMARY OF THE INVENTION

A bracket assembly for supporting seed planting appurtenances in substantial alignment with respect to a seed tube of an agricultural planter. The bracket assembly

comprises a housing having opposing first and second sides. The housing includes mounting structure for rigidly securing the housing operably with respect to the planter frame. The sides of the housing further include interior walls for maintaining the sides of the housing in spaced apart relation. The housing may support various appurtenances alone or in combination, including a resilient tool, a liquid conduit, and a support arm for supporting any number of desired conduits all in substantial alignment with the seed tube.

5 The various embodiment of the improved bracket assemblies of the present invention are illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the 10 specific form illustrated and described without materially departing from the teachings herein.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of a typical agricultural seed planter.

15 FIG. 2 is a side elevation view of a prior art bracket assembly installed on an agricultural seed planter.

FIG. 3 is a detailed view showing the interior structure of the two sides of the prior art bracket assembly of FIG. 2.

FIG. 4 is a side elevation view of another prior art bracket assembly installed on an agricultural seed planter.

20 FIG. 5 is a detailed view showing the interior structure of the two sides of the prior art bracket assembly of FIG. 4.

FIG. 6 is a detailed view of the interior structure of one embodiment of an improved bracket assembly of the present invention.

25 FIG. 7 is a side elevation view of the improved bracket assembly of FIG. 6 installed on a agricultural seed planter.

FIG. 8 is a detailed view of the interior structure of another embodiment of an improved bracket assembly of the present invention.

FIG. 9 is a side elevation view of the improved bracket assembly of FIG. 8 installed on a agricultural seed planter.

30 FIG. 10 is a detailed view showing the interior structure of another embodiment of an improved bracket assembly of the present invention.

FIG. 11 is a side elevation view of the improved bracket assembly of FIG. 10 installed on a agricultural seed planter.

FIG. 12 is a side elevation view of another embodiment of the improved bracket assembly of the present invention installed on a agricultural seed planter;

5 FIG. 13 is a side elevation view of another embodiment of the improved bracket assembly of the present invention installed on a agricultural seed planter;

FIG. 14 is a perspective view of an embodiment for a support arm.

DETAILED DESCRIPTION OF THE INVENTION

Drawing FIG. 1 illustrates a partial side elevation view of a typical John Deere 10 row-crop agricultural seed planter 10. The seed planter 10 of FIG. 1, comprises a wheeled main frame (not shown) adapted to be pulled by a prime mover (not shown). The wheeled main frame includes a transversely disposed tool bar 12 that supports a plurality transversely spaced row unit assemblies 14. The row unit assemblies 14 are generally vertically adjustable with respect to the tool bar 12, such as by a parallel 15 linkage 16 or the like. Each row unit assembly 14 is generally comprised of a longitudinally disposed row unit frame 18 which typically supports at least one seed hopper 20 and an insecticide hopper 21, a seed tube 22, a seed tube guard 24, a furrow opening assembly 26, and a furrow closing assembly 28. The furrow opening assembly 26 is typically comprised of a pair of furrow opening discs 30 and a pair of gauge wheels 20 32. The furrow opening discs 30 are supported on a transverse shaft 34 depending from the row unit frame 18. The seed tube 22 is disposed rearwardly of the shaft 34 and between the opening discs 30 such that the seed tube 22 is in substantial alignment with a furrow 36 created by the opening discs 30.

In operation, the furrow opening discs 30 cut a V-shaped furrow 36 in the soil 25 surface 38 as the planter 10 traverses the field. Seeds 40 from the seed hopper 20 are singulated by a seed metering device 42 before being discharged into the seed tube 22 wherein the seeds 40 are directed downwardly and rearwardly for depositing into the seed furrow 36. After the seeds 40 are deposited into the furrow 36, the furrow closing 30 assembly 28 closes the furrow 36 by pushing soil over the deposited seeds 40. A more detailed description of the agricultural seed planter 10 of FIG. 1 is provided in U.S.

Patent No. 4,009,668, the specification and drawings of which are incorporated herein by reference.

It should be understood that the particular structure and arrangement of components comprising an agricultural planter or drill may vary by manufacturer, and thus, the agricultural seed planter of FIG. 1 is provided and discussed to merely provide a general example and frame of reference for use later in this specification when discussing the relative positions of the structural components typical of most agricultural planters and drills. Thus, any reference to an agricultural planter in the present application should be understood to include any agricultural row-crop seed planter or drill and not just the specific type of planter illustrated in FIG. 1.

Drawing FIGs. 2 and 4 illustrate, side elevation views of two types of existing bracket assemblies 100, 200 shown, by way of example only, installed on the agricultural planter 10 of FIG. 1, with one of the gauge wheels 32 and furrow opening discs 30 removed for clarity. FIGs. 3 and 5 are more detailed views showing the internal structure of the bracket assemblies 100, 200 of FIGs. 2 and 4, respectively. The bracket assemblies of FIGs. 3 and 5 are presently manufactured by Precision Planting, Inc., 23207 Townline Road, Tremont, Illinois 61568.

Referring to FIGs. 2 and 3, the existing bracket assembly 100 comprises a housing 112 having opposing, substantially mirror-image sides 114, 116. The housing 112 is made of thermoplastic material formed using an injection molding process. The bracket assembly 100 further includes mounting structure 118, comprising upper and lower ears 120, 122. The housing 112 further includes walls 124 for maintaining the first and second sides 114, 116 in spaced apart relation. The walls 124 further define a cavity 126 within which an upper end of a resilient tool 900 is receivable. The housing 112 further includes conduit supports 128 extending rearwardly and formed integrally with the housing for receiving a liquid conduit 910. The conduit supports 128 support and guide the liquid conduit 910 away from the furrow opening discs 30.

To install the bracket assembly 100, the gauge wheels 32 are removed from the row unit. The furrow opening discs 30 are also removed from the opening disc shaft 34. The sides 114, 116 of the housing 112 are mounted on opposing sides of the opening disc shaft 34 by placing the upper ears 120 over the shaft 34. The roll pin securing the tube

guard 24 to the row unit frame 18 is removed and lower ears 122 are attached to the seed tube guard 24 by aligning the openings and securing with a bolt and nut connection replacing the removed roll pin. The two sides 114, 116 of the housing are then secured together by inserting carriage bolts 130 through the apertures 132 in the sides of the housing 112. Once the bracket assembly 100 is mounted, the upper end of the resilient tool 900 is inserted into the cavity 126 (FIG. 3) defined by the walls 124 formed in the interior sides 114, 116 of the housing 112. The walls 124, in addition to defining the cavity 126 for receivably supporting the upper end of the resilient tool 900, also act as spacers to maintain a sufficient distance between the opposing sides 114, 116 to receive the upper end of the resilient tool 900 and to maintain the opposing side 114, 116 a sufficient distance apart such that the upper and lower ears 120, 122 extend around the seed tube 22 on either side thereof as shown in FIG. 2. With the resilient tool 900 installed in the housing 112, the adjusting screw 134 is tightened to adjust the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 112, thereby increasing or decreasing the amount of force to be exerted by the resilient tool in the bottom of the seed furrow 36. The furrow opening discs 30 are then replaced and secured to the shaft 34 and the gauge wheels 32 are replaced.

If in-furrow liquid application is desired, one end of the liquid conduit 910 is inserted through the conduit supports 128. The liquid conduit 910 extends along the back of the resilient tool 900, terminating at the rearward end of the resilient tool 900. The other end of the liquid conduit 910 is fluidly connected to a liquid supply reservoir (not shown) located on the planter or prime mover. In operation, liquid is pumped from the liquid supply reservoir through the liquid conduit 910 for depositing in the furrow 36 behind the resilient tool 900.

The other existing bracket assembly 200 of FIGs. 4 and 5 is similar to the bracket assembly 100 of FIGs. 2 and 3, in that it comprises a housing 212 having substantially mirror-image opposing sides 214, 216. The housing 212 is made of thermoplastic material formed using an injection molding process. The bracket assembly 200 further includes mounting structure 218, comprising apertures 220 in the upper end of the housing 212 which mate with existing apertures provided in the row unit frame 18. The housing 212 further includes walls 224 for maintaining the first and second sides 214,

216 in spaced apart relation. The walls 224 further define a cavity 226 within which an upper end of a resilient tool 900 is receivable. The housing 212 further includes conduit supports 228 extending rearwardly and formed integrally with the housing for receiving a liquid conduit 910. The conduit supports 228 support and guide the liquid conduit 910 away from the furrow opening discs 30.

5 The bracket assembly 200 is mounted to the row unit frame 18 by a bolt and nut connection through the mating aligned apertures. With the housing 212 mounted to the row unit frame 18, the two sides 214, 216 of the housing are then secured together by inserting carriage bolts 230 through the apertures 232 in the sides of the housing 212. 10 Once the bracket assembly 200 is mounted, the resilient tool 900 may be inserted into the cavity 226 (FIG. 5) defined by the walls 224 formed in the interior sides 214, 216 of the housing 212. The walls 224, in addition to defining the cavity 226 for receivably supporting the resilient tool 900, also act as spacers to maintain a sufficient distance between the opposing sides 214, 216 to receive the upper end of the resilient tool 900. 15 With the resilient tool 900 installed in the housing 212, an adjusting screw 234 is tightened to adjust the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 212, thereby increasing or decreasing the amount of force to be exerted by the resilient tool in the bottom of the furrow 36.

20 If in-furrow liquid application is desired, one end of the liquid conduit 910 is inserted through the conduit supports 228. The liquid conduit 910 extends along the back of the resilient tool 900, terminating at the rearward end of the resilient tool 900. The other end of the liquid conduit 910 is fluidly connected to a liquid supply reservoir (not shown) located on the planter or prime mover. In operation, liquid is pumped from the liquid supply reservoir through the liquid conduit 910 for depositing in the furrow 36 25 behind the resilient tool 900.

FIGs. 6-14 illustrate various embodiments of improved bracket assemblies comprising the present invention. Referring, first to FIG. 6, a first embodiment of an improved bracket assembly 300 is shown. As with the existing bracket assembly 100, this first improved bracket assembly 300 comprises a housing 312 having opposing, 30 preferably substantially mirror-image, first and second sides 314, 316. The housing 312 preferably includes mounting structure 318 comprising upper and lower ears 320, 322.

However, rather than the ears 320, 322 formed from thermoplastic material as in the existing bracket assembly 100, the upper ears 320 comprise metal ears tabs preferably integrally attached with the housing 312 by inserting molding the metal ears tabs 320 during the injection molding process when forming the housing 312. Alternatively, 5 rather than insert molding, the metal ear tabs 320 may be integrally attached to the housing 312 by a rivet connection, bolted connection, adhesives or welding by any known means, or any other joining processes. The housing 312 further includes walls 324 for maintaining the first and second sides 314, 316 in spaced apart relation. The walls 324 further define a cavity 326 within which an upper end of a resilient tool 900 is receivable. 10 The housing 312 preferably includes conduit supports 328 extending rearwardly and formed integrally with the housing 312 for receiving a liquid conduit 910. In the preferred embodiment, a locking member 334, such as a threaded connector, is provided operable on the upper end of the resilient tool 900 to restrain the resilient tool within the cavity 326. Depending on the type of resilient tool 900 installed, the locking member 15 334 is also preferably operable on the upper end of the resilient tool 900 to adjust the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 312, by adjusting the position of the locking member 334 with respect to the housing 312. Additionally, as shown in FIG. 7, support arm 800 (shown in dashed lines) (discussed later) may be supported by the housing 312 to support any desired number of 20 conduits 920.

Continuing to refer to FIG. 7, to install this first improved bracket assembly 300 on an agricultural planter 10 the method is substantially the same as that described for the existing bracket assembly 100. First, if necessary, depending on the type of agricultural planter, the gauge wheels 32 on the row unit are removed and furrow opening discs 30 are removed from the opening disc shaft 34. The sides 314, 316 of the housing 312 are 25 mounted on opposing sides of the opening disc shaft 34 by placing the upper ears 320 over the shaft 34. The roll pin securing the tube guard 24 to the row unit frame 18 is removed and lower ears 322 are attached to the seed tube guard 24 by aligning the openings and securing with a bolt and nut connection which replaces the removed roll pin. The two sides 314, 316 of the housing 312 preferably include apertures 332 for 30 receiving a threaded connector 330, however other suitable means of connection,

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recognized by those skilled in the art may also be used. Once the first bracket assembly 300 is mounted, the upper end of the resilient tool 900 may be inserted into the cavity 326 defined by the walls 324 formed in the interior sides 314, 316 of the housing 312. The walls 324, in addition to defining the cavity 326 for receivably supporting the upper end of the resilient tool 900, also act as spacers to maintain a sufficient distance between the opposing sides 314, 316 to receive the upper end of the resilient tool 900 and to maintain the opposing side 314, 316 a sufficient distance apart such that the upper and lower ears 320, 322 extend around the seed tube 22 on either side thereof as shown in FIG. 7, for example. In the preferred embodiment, the locking member 334 is then adjusted to lock the resilient tool 900 within the cavity 326. Depending on the type of resilient tool 900 installed, the locking member 334 is also preferably operable to adjust the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 312 to thereby increasing or decreasing the amount of force exerted by the resilient tool 900 in the bottom of the furrow 36. The furrow opening discs 30 are then replaced and secured to the shaft 34 and the gauge wheels 32 are replaced.

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If in-furrow liquid application is desired, one end of the liquid conduit 910 is inserted through the conduit supports 328. Depending on the type of resilient tool 900 used, the liquid conduit 910 may extend along the back of the resilient tool 900, terminating at the rearward end of the resilient tool 900 as shown, for example, as shown in FIG. 7. The other end of the liquid conduit 910 is fluidly connected to a liquid supply reservoir (not shown) located on the planter or prime mover. In operation, liquid is pumped from the liquid supply reservoir through the liquid conduit 910 for depositing in the furrow 36, preferably behind the resilient tool 900.

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Referring, now to FIG. 8, another embodiment of an improved bracket assembly 400 is shown. This second improved bracket assembly 400 comprises a housing 412 having opposing, preferably substantially mirror-image, first and second sides 414, 416. The housing 412 preferably includes mounting structure 418 comprising upper and lower ears 420, 422. The upper ears 420 preferably comprise metal ears tabs preferably integrally attached with the housing 412 by inserting molding the metal ears tabs 420 during the injection molding process when forming the housing 412. Alternatively, rather than insert molding, the metal ear tabs 420 may be integrally attached to the

housing 412 by a rivet connection, bolted connection, adhesives or welding by any known means, or any other joining processes. The housing 412 further includes walls 424 for maintaining the first and second sides 414, 416 in spaced apart relation. The walls 424 further define a cavity 426 within which an upper end of a resilient tool 900 is receivable. The walls 424 further define a passageway 428 which extends through at least a portion of the housing 412 through which a liquid conduit 910 is receivable. In the preferred embodiment, a locking member 434, such as a threaded connector, is provided operable on the upper end of the resilient tool 900 to restrain the resilient tool within the cavity 426. Depending on the type of resilient tool 900 installed, the locking member 434 is also preferably operable on the upper end of the resilient tool 900 to adjust the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 412, by adjusting the position of the locking member 434 with respect to the housing 412.

As shown in FIG. 9, a support arm 800 (shown in dashed lines) (discussed later) may be supported by the housing 412 to support any desired number of conduits 920. As previously identified, the second improved bracket assembly 400 includes a passageway 428 defined by the walls 424. The passageway 428 extends through at least a portion of the housing 412 through which a liquid conduit 910 is receivable. Accordingly, if in-furrow liquid application is desired, one end of the liquid conduit 910 is inserted through the passageway 428 within the housing 412. Depending on the type of resilient tool 900 installed in the cavity 426, the liquid conduit 910 may extend along the back of the resilient tool 900, terminating at the rearward end of the resilient tool 900 as shown in FIG. 9. The other end of the liquid conduit 910 is fluidly connected to a liquid supply reservoir (not shown) located on the planter or prime mover. In operation, liquid is pumped from the liquid supply reservoir through the liquid conduit 910 for depositing in the furrow, preferably behind the resilient tool 900.

Referring, now to FIG. 10, yet another improved bracket assembly 500 is shown. This third improved bracket assembly 500 comprises a housing 512 having opposing, preferably substantially mirror-image, first and second sides 514, 516. The sides 514, 516 of the housing further include mounting structure 518, comprising apertures 520 in the upper end of the housing 512 adapted to mate with apertures provided in the row unit frame 18. The housing 512 further includes walls 524 for maintaining the first and

second sides 514, 516 in spaced apart relation. The walls 524 further define a cavity 526 within which an upper end of a resilient tool 900 is receivable. The walls 524 further define a passageway 528 which extends through at least a portion of the housing 512 through which a liquid conduit 910 is receivable. In the preferred embodiment, a locking member 534, such as a threaded connector, is provided operable on the upper end of the resilient tool 900 to restrain the resilient tool within the cavity 526. Depending on the type of resilient tool 900 installed, the locking member 534 is also preferably operable on the upper end of the resilient tool 900 to adjust the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 512, by adjusting the position of the locking member 534 with respect to the housing 512.

As shown in FIG. 11, a support arm 800 (shown in dashed lines) (discussed later) may be supported by the housing 512 to support any desired number of conduits 920. The third improved bracket assembly 500 is preferably mounted to the row unit frame 18 by a bolt and nut connection through the mating aligned apertures. With the housing 512 mounted to the row unit frame 18, the two sides 514, 516 of the housing are then secured together. The two sides 514, 516 of the housing 512 preferably include apertures 532 for receiving a threaded connector 530, however other suitable means of connection, recognized by those skilled in the art may also be used. Once the third improved bracket assembly 500 is mounted, the resilient tool 900 may be inserted into the cavity 526 defined by the walls 524 formed in the interior sides 514, 516 of the housing 512. The walls 524, in addition to defining the cavity 526 for receivably supporting the upper end of the resilient tool 900, also act as spacers to maintain a sufficient distance between the opposing sides 514, 516 to receive the upper end of the resilient tool 900. In the preferred embodiment, the locking member 534 is then adjusted to lock the resilient tool 900 within the cavity 526. Depending on the type of resilient tool 900 installed, the locking member 534 also preferably adjusts the position of the lower end of the resilient tool 900 with respect to the lower end of the housing 512 to thereby increasing or decreasing the amount of force exerted by the resilient tool 900 in the bottom of the furrow 36.

As previously identified, the third improved bracket assembly embodiment 500 includes a passageway 528 defined by the walls 524. The passageway 528 extends

through at least a portion of the housing 512 through which a liquid conduit 910 is receivable. Accordingly, if in-furrow liquid application is desired, one end of the liquid conduit 910 is inserted through the passageway 528 within the housing 512. Depending on the type of resilient tool 900 installed in the cavity 526, the liquid conduit 910 may extend along the back of the resilient tool 900, terminating at the rearward end of the resilient tool 900 as shown in FIG. 11. The other end of the liquid conduit 910 is fluidly connected to a liquid supply reservoir (not shown) located on the planter or prime mover. In operation, liquid is pumped from the liquid supply reservoir through the liquid conduit 910 for depositing in the furrow, preferably behind the resilient tool 900.

It should be understood that although the preferred embodiments of the improved bracket assemblies 300, 400, 500 are described and illustrated to be particularly adapted for use with the Keeton™ seed firmer type resilient tools 900, those skilled in the art will recognize and appreciate that the bracket assemblies, 300, 400, 500 could be modified to accommodate other resilient tools, such as those disclosed in U.S. Patent Nos. 2,533,474 issued to Hyland; 5,092,255 issued to Long et al.; and 6,283,050 issued to Schaffert. Those skilled in the art will recognize that in order to receive and support such other resilient tools 900, the housing and interior walls defining the cavities merely need to be configured to receiving and support an upper end of such resilient tools. Accordingly, the present invention should not be construed as being limited to a bracket assembly particularly adapted to receive and support only Keeton™ seed firmer type resilient tools.

FIG. 12 illustrates yet another embodiment of an improved bracket assembly 600 having a support arm 800 (described later) for supporting any desired number of conduits 920. Furthermore, this fourth improved bracket assembly 600 need not receive and support a resilient tool 900. The fourth improved bracket assembly 600 comprises a housing 612 having opposing, preferably substantially mirror-image, first and second sides 614, 616. The housing 612 preferably includes mounting structure 618 comprising upper and lower ears 620, 622. The upper ears 620 may be formed from the same material as the rest of the housing 612, but preferably the upper ears 620 comprise metal ears tabs integrally attached to the housing 612 as previously described with respect to the first and second improved bracket assemblies 300, 400. The housing 612 further includes walls 624 for maintaining the first and second sides 614, 616 in spaced apart

relation. The housing 612 may include conduit supports (not shown) similar to the conduit supports 328 as in the first improved bracket assembly embodiment 300, or alternatively the walls 624 may define a passageway (not shown) similar to the passageway 428 as in the second improved bracket assembly embodiment 400. The fourth improved bracket assembly 600 may be mounted to the planter frame 18 in the same manner as previously described for the first and second improved bracket assembly embodiments 300, 400.

5 FIG. 13 illustrates yet another embodiment of an improved bracket assembly 700 having a support arm 800 (described later) for supporting any desired number of conduits 920. Furthermore, this fifth improved bracket assembly 700 need not receive and support 10 a resilient tool 900. The fifth improved bracket assembly 700 comprises a housing 712 having opposing, preferably substantially mirror-image, first and second sides 714, 716. The two sides 714, 716 of the housing 712 preferably include apertures 732 for receiving 15 a connector 730, however other suitable means of connection, recognized by those skilled in the art may also be used. The housing 712 further includes walls 724 for maintaining the first and second sides 714, 716 in spaced apart relation. The housing 712 may include conduit supports (not shown) similar to the conduit supports 228 as in the existing bracket assembly 200, or alternatively the walls 624 may define a passageway (not shown) similar to the passageway 528 as in the third improved bracket assembly embodiment 500. The fifth improved bracket assembly 700 may be mounted to the planter frame 18 in the same manner as previously described for the third improved bracket assembly embodiment 500.

20 FIG. 14 illustrates a perspective view of one embodiment of a support arm 800. The support arm 800 may be attached to the foregoing first, second and third improved bracket assembly embodiments 300, 400, 500 for example, as shown by dashed lines in 25 FIGs. 7, 9 and 11, or to the fourth and fifth bracket assembly embodiments 600, 700, for example as shown in FIGs. 12 and 13. As previously discussed, the support arm may be used to support any number of desired conduits 920. For example, the support arm 800 may support a conduit 920 in fluid communication with the same liquid supply reservoir previously discussed to which the liquid conduit 910 is in fluid communication, or the 30 conduit 920 may be the same liquid conduit 910. Alternatively, the conduit 920 may be

in fluid communication with a second liquid supply (not shown) to deliver a second liquid supply to the furrow 36. Alternatively, the conduit 920 may be in communication with the insecticide hopper 21 or another reservoir containing insecticides, fungicides or other liquid, powder or granular products or chemicals desired for in-furrow application.

5 The support arm 800 may be integral and formed with the housing 312, 412, 512, 612, 712 during the preferred injection molding process for forming the improved bracket assembly embodiments 300, 400, 500, 600, 700. Preferably, however, the support arm 800 is a separate assembly that removably attaches to the housing 312, 412, 512, 612, 712 of the improved bracket assembly embodiments 300, 400, 500, 600, 700. As shown 10 in FIG. 14, the support arm 800 includes an elongated arm 802, having a first end 804 terminating in a U-shaped channel 806 adapted to receive the lower end of the housing 312, 412, 512, 612, 712. Additionally, the support arm 800 preferably includes an aperture 808 within the U-shaped channel 806 which is adapted to mate with the aperture for the locking member 334, 434, 534, 634, 734 of the improved bracket assembly 300, 400, 500, 600, 700 such that the locking member 334, 434, 534, 634, 734 removably 15 secures the support arm 800 to the housing 312, 412, 512, 612, 712 of the improved bracket assembly 300, 400, 500, 600, 700. The other end of the arm 808 preferably includes a fitting 810 adapted to receive and support the conduit 920. Depending on the product to be communicated to the furrow, the fitting 810 may simply comprise a pipe 20 section sized to receive and support the conduit 920, for example as shown in FIG. 12. Alternatively, the fitting 810 may comprise a nozzle fitting that connects to the end of the conduit 920 to provide a desired spray pattern for the product being applied as shown in FIG. 13. Furthermore, one or more additional fittings 810 could be provided along the length of the arm 802 to support multiple conduits 910, 920.

25 It should be appreciated that various means of supporting the support arm 800 from the housing 312, 412, 512, 612, 712 are possible, depending on the configuration of the bracket assembly. For example, rather than a U-shaped channel 806, the first end 804 may simply include a flange or other structure which secures to the housing by a clip, threaded connector or any other method for connecting. Accordingly, the support arm 30 800 should not be considered as limited to the embodiment shown in FIG. 14.

Additionally, the desired length of the support arm 800 may vary depending on space

constraints, the number of conduits 920 to be supported, or whether it is desired to deliver the product with respect to the seed tube 22.

Although only certain exemplary embodiments of the applicants' present invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the following claims.

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